

REMARKS

The Applicants would like to thank the Examiner for the time extended for the courtesy of the office interview, conducted on November 29, 2005, in which agreement with respect to the claims was reached.

Claims 1-26 and currently pending in the application. Claims 1, 7-9, 13-15, and 17-22 have been amended in this response. New Claims 23-26 have been added. No new matter is believed to be added by this amendment. In addition, unless a passage of an amendment is specifically discussed below in connection with one or more cited references, Applicants respectfully submit that the remarks accompanying this amendment should be constructed as being submitted merely to clarify the invention rather than as a limitation submitted to overcome a cited reference.

Claim Rejections under 35 U.S.C. §103(a)

Applicants respectfully traverse the rejections of Claims 1-22 under 35 U.S.C. §103(a) and respectfully requests that, in accord with the agreement reached in the office interview, the Examiner reconsider and withdraw the rejections of the pending claims 32 and 34, as currently presented.

Independent Claims 1, 9, 15, 19, 20, 21 and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Foster et al (IEEE Ultrasound Symposium 200 pp. 1633 et seq.) in view of United States Patent No. 4,991,589 to Hongo, or United States Patent No. 5,579,771 to Bonnefous, or United States Patent No. 6,139,500 to Clark, or United States Patent No. 6,544,175 to Newman.

The Examiner suggests that Foster teaches high frequency, high frame rate scanning

appurtenant to cardiac scanning of a small animal organ. Further, the Examiner suggests that the remaining prior art citations teach the breaking up of volumes or frames into subunits or collapsed width frames under acquisition in accordance with ECG timings to achieve higher relative frame rates.

The Hongo disclosure teaches an apparatus that is configured to produce a plurality of frames of Doppler image information by scanning a region of interest multiple times in response to heartbeat signals produced by an ECG adapted to detect heartbeats of a subject under examination. In Hongo, the scans of the ROI are sequentially delayed from corresponding heartbeat signals in increments of a regular time interval and each frame of image information is stored in a frame memory in the form of divided sub-frame signals. Further corresponding sub-frame signals of the frame signals are selectively read from the frame memory and then synthesized to reconstruct one frame image.

Bonnefous teaches a method and apparatus configured for the detection and characterization of a segment of an artery by ultrasonic echography. In this system, an echograph, of the type involving signal processing in the time domain with correlation-interpolation of the echographic signals, is adapted to measure radial displacement velocities of the walls of an artery. In use, a frame is scanned with a period T of a few ms at a rate of one excitation per line, and the correlations-interpolations are performed between collinear excitation lines shifted by the period T . Resultingly, velocity values $V(x, z, t)$ and amplitude values $A(x, z, t)$ are derived for storage in respective first and second memories. The velocity and amplitude values are subsequently processed in order to deduce dilatation and compression curves therefrom.

In Clark, a method and apparatus for medical ultrasound imaging is disclosed. In this reference, an ultrasound beam is scanned in a fast scan direction and is concurrently scanned in a

slow scan direction. During scanning of the ultrasound beam, ultrasound data samples, representative of two-dimensional slices of a volume of interest in a patient, are acquired at different points in the slow scan direction and at different times in the patient's cardiac cycle. Scanning in the slow scan direction is controlled relative to the patient's cardiac cycle so that the acquired data samples have a desired spatial distribution over the volume of interest and a desired temporal distribution over the patient's cardiac cycle. The acquired data samples are converted to three-dimensional image data sets that represent the volume of interest at different times in the patient's cardiac cycle. Scanning in the slow scan direction is controlled by starting scanning at uniformly-spaced time intervals relative to the patient's cardiac cycle.

Finally, the Newman reference discloses an ultrasound imaging system that produces a seemingly real-time display by obtaining ultrasound data in an interleaved manner. In this system, a transducer outputs and receives ultrasonic signals and comprises circuitry that causes the transducer to output the ultrasonic signals in a series of frames in an interleaved manner so as to isonify each of a plurality of portions of a subject matter at different times and forms an image based on the echoes from a plurality of frames.

Each of the noted references requires that entire image frames of data are acquired repeatedly and then some degree of manipulation is applied to the individual image frames to derive a suitable form for display. Each of the references uses data derived from complete image frames.

In contrast to the teachings of the combinations of the cited disclosures, the invention set forth in the pending independent claims, Claims 1, 9, 15, 19, 20, 21 and 22 as currently amended, is for a system in which a means for transmitting ultrasound, which has been transmitted into a subject at a frequency of at least 20MHz, and a means for receiving ultrasound are incrementally repeated from a first scan line position through an nth scan line position. At each respective scan

line position, a plurality of scan lines are generated – each respective scan line being offset in time from a reference point of an ECG rhythm. The received ultrasound is processed to provide an image having an effective frame rate of at least 200 frames per second. The system uses line based reconstruction, which comprises a means for assembling the plurality of scan lines based on the scan line position and the point of time offset from the reference point to form an image frame.

Accordingly, one skilled in the art would not have been motivated to modify Foster and the combination on any of the cited Hongo, Bonnefous, Clark, or Newman references to arrive at the claimed invention because there is no teaching to make the modification. Nor is there any suggestion of such a methodology or apparatus in the cited Foster, Hongo, Bonnefous, Clark, and/or Newman disclosures. Thus, a modification to generate a plurality of scan lines at each incremental scan line position, in which each respective scan line is offset in time from a reference point of an ECG rhythm and to subsequently reconstruct the plurality of scan line data based on the scan line position and the point of time offset from the reference point to form an image frame having an effective frame rate of at least 200 frames per second would require hindsight reasoning, which the Federal Circuit has explicitly rejected. *See In re Fritch*, 972 F.2d 1260, 23 U.S.P.Q.2d 1780, 1783 (Fed. Cir. 1992) ("Here, the Examiner relied upon hindsight to arrive at the determination of obviousness. It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious.").

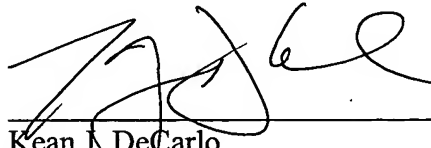
Therefore, Claims 1, 9, 15, 19, 20, 21 and 22, as amended, would not be rendered obvious by the cited combinations of references. Accordingly, the claims dependent upon independent Claims 1, 9, 15, 19, 20, 21 and 22 are also allowable over the cited art. *See In re Fine*, 5 U.S.P.Q.2d 1569, 1600 (Fed. Cir. 1988) ("Dependent claims are nonobvious under section 103 if the independent claims from which they depend are nonobvious.").

ATTORNEY DOCKET NO. 22126.0002U1
Amendment

Therefore, Applicants respectively request allowance of all the outstanding claims. The Examiner is invited and encouraged to contact directly the undersigned if such contact may enhance the efficient prosecution of this application to issue.

Credit Card Authorization form PTO-2038 in the amount of \$325.00 (\$100.00 for four new dependent claims and \$255.00 for a Two-Month Extension of Time) is enclosed. No additional fees are believed to be due; however, the Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-0629.

Respectfully submitted,

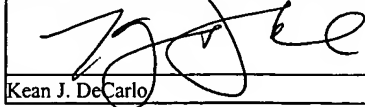


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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to:
MAIL STOP AMENDMENT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on December 8, 2005.



Kean J. DeCarlo

12/8/2005

Date